PATENT
P-5026

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SERIAL NO.: 09/892,061 GROUP: 1744

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FOR: System and Method for Optically Monitoring the Concentration of a Gas, or the Pressure in a Sample Vial to Detect Sample Growth.

Commissioner of Patents
P.O. Box 1450
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DECLARATION UNDER 37 C.F.R. § 1.131

1. I, Nicholas R. Bachur Jr., am an inventor on the above-captioned patent application.

2. Prior to July 13, 2000, I and my co-inventors reduced to practice systems having an optically transparent sample container, a tunable laser configured to emit a beam through the container, and a detector for detecting the light passing through the container. A description and schematic of these systems is attached. Experiments were successfully run on the systems prior to July 13, 2000.

3. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment or both, under 18 U.S.C. 1001, and that such willful false statements may jeopardize the validity of this application, any patent issuing thereon, or any patent to which this Declaration directed.

21/June/05
Date

Nicholas R. Bachur, Jr.
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3. EXPERIMENTAL SETUP

The feasibility demonstration project included a variety of experimental configurations ranging from benchtop measurements of sealed Bactec bottles containing calibration gas mixtures to measurement of CO_2 and O_2 kinetics during actual blood culture runs in a modified Bactec 9050. The two diode lasers used performed well, but neither operated at its optimum wavelength. Measurements of CO_2 concentrations were made using a distributed feedback (DFB) InGaAsP laser (Sensors Unlimited) that is tunable over a limited range near 2000 nm. This spectral region accesses CO_2 absorption lines that are only about 40% as strong as the optimum CO_2 line at 2004 nm. (A new laser, also from Sensors Unlimited, that operates at 2004 nm was received late in the project, but was not used.) Oxygen concentrations were measured using a vertical cavity, surface emitting (VCSEL) GaAlAs laser from CSEM. Although VCSELs have wider tuning ranges than DFB lasers – and the CSEM devices can cover much of the O_2 A band – for convenience we selected a laser operating temperature near room temperature. As a result, the laser output wavelength was ~761.5 nm and the O_2 absorption line used is a factor of 2.5 *weaker* than optimum.

A schematic diagram of the experimental configuration is shown in Fig. 3. For this short project, we used commercial components rather than more compact and optimized circuitry that would be used in a final configuration. Control and data acquisition are performed using LabView software on a PC in conjunction with a National Instruments PCI-MIO-16E-1 data acquisition board. The computer can also communicate with and control the lock-in via a GPIB interface. Data files are analyzed using the MATLAB programming environment.

The computer generates a ramp waveform to sweep the laser across the spectral line while the lock-in generates the modulation sine wave at 48 kHz. These are input to the laser controller and added to the DC offset current to tune the laser. The laser is maintained at a fixed temperature.

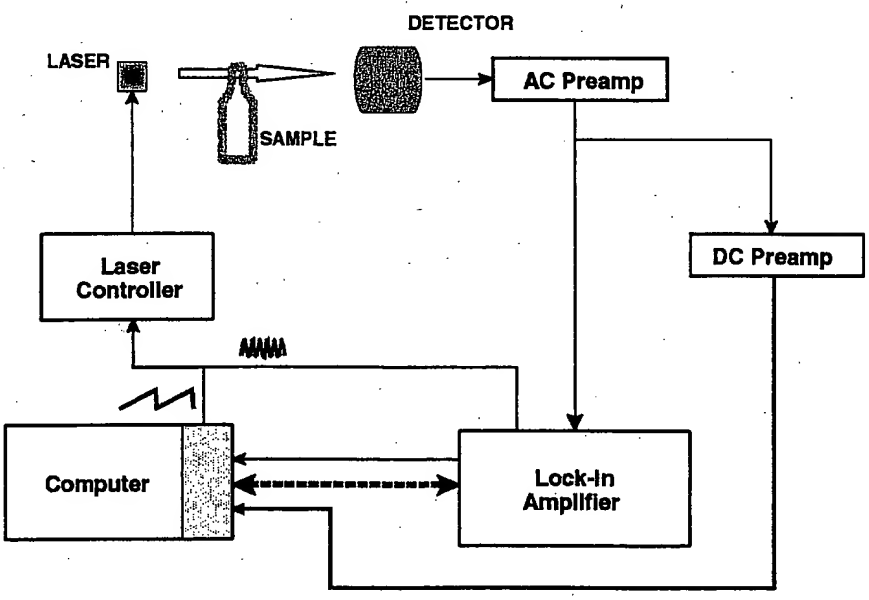

Figure 3 - Experimental setup.

The photocurrent is amplified and converted to volts, then split into a high frequency (AC signal) and low frequency (I_0 or DC signal). The AC signal is demodulated at the selected harmonic (second harmonic for nearly all experiments) and then the lock-in output and DC signals are read by A/Ds in the computer.

Static and transient measurements of the bottles are made. In the static experiments, the bottle is placed in the optical path and repetitive spectra recorded. Because of the fixed nature of this setup, the spectra are more prone to observation of etalons.

For the dynamic measurements, the bottle revolved either on a 33 rpm turntable for CO_2 or 4.6 rpm in a modified Bactec 9050 for O_2. In the case of CO_2, we used discrete rf components instead of the lock-in and pre-amplifiers with a modulation frequency of 250 kHz. Scans in this configuration were performed at 1 kHz. For the slower O_2 runs, we used the lock-in and a 150 Hz spectral scan rate. Optical path lengths ranged from 3.0 to 4.0 cm.